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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/639,625	08/15/2000	Steven Towle	42390P7195	1669

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EXAMINER

OWENS, DOUGLAS W

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 10/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/639,625

Applicant(s)

TOWLE ET AL.

Examiner

Douglas W Owens

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 July 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 23-48 is/are pending in the application.
- 4a) Of the above claim(s) 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 21 and 23-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 12. 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. The declaration filed on July 21, 2003 under 37 CFR 1.131 is sufficient to overcome the Chooi et al. reference.

Claim Objections

2. Claim 46 is objected to because of the following informalities: the underlining of "fluorinated" should be removed. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 36 – 42 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 36 recites the limitation, "...placing the substrate into a reaction chamber and simultaneously exposing...". There is no disclosure of exposing the fluorine containing film to plasma while simultaneously placing the substrate into a reaction chamber.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

Art Unit: 2811

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 29, 32 and 33 are rejected under 35 U.S.C. 102(e) as being anticipated by US patent No. 6,054,398 to Pramanick.

Regarding claim 29, Pramanick teaches a method of forming a dielectric, comprising:

forming a fluorine containing film (Fig. 3, 216) on a substrate having a top surface;

depositing a hardmask layer (117) on the top surface of the fluorine containing film;

forming via openings (Col. 1, line 13 – Col. 2, line 5) in the fluorine containing film, wherein the via openings define sidewalls; and

exposing the hardmask layer and the sidewalls to a reducing plasma (Col. 4, lines 58 – 64).

Regarding claim 32, Pramanick teaches a method, further comprising depositing a conductive material (Fig. 4, 202; Col. 4, lines 31 – 37) in the via openings.

Regarding claim 33, Pramanick teaches a method wherein depositing the hardmask comprising forming a layer of silicon nitride (Col. 4, lines 37 – 41) over the top surface of the fluorine containing film.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1 – 17, 21, 23 – 28, 30, 31 and 34 – 48 are rejected under 35 U.S.C.

103(a) as being unpatentable over US patent No. 6,054,398 to Pramanick.

Regarding claims 1, 8, 9, 10, 11, 13, 21, 24, 30, 31, 36, 41 – 44 and 46,

Pramanick teaches a method of forming a dielectric, comprising:

forming a fluorine containing film (Fig. 3; 216; Col. 4, lines 3 – 5)) on a substrate;
forming via openings in the fluorinated material; and
exposing the fluorine containing film top surface and sidewalls to a reducing plasma (Col. 4, lines 58 – 64).

Pramanick does not teach placing the substrate in a reaction chamber or forming the plasma remote from the chamber. The step of exposing the fluorine containing film would have required a reaction chamber to control the plasma flow and to prevent undesired elements from reacting with the fluorine containing film. It would have been obvious to one of ordinary skill in the art to place the substrate in a reaction chamber, since it is desirable to control the reaction with the plasma. Pramanick is silent with respect to the source of the plasma. One having ordinary skill in the art would have been required to select a known method of providing the plasma. It would have been required and obvious to one having ordinary skill in the art to select a known plasma

Art Unit: 2811

source, such as remote plasma, since Pramanick does not disclose the preferred plasma source.

Pramanick teaches a method, wherein low dielectric fluorinated layers are used. Pramanick does not teach that the low dielectric constant fluorinated layer comprises a-C:F, parylene AF4, carbon-doped SiOF, fluorinated organic polymers, fluorinated siloxane polymers, and SiOF. The cited materials are well known low dielectric constant fluorinated layers. It would have been obvious to one having ordinary skill in the art to select a known material that is well suited for the intended use. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Regarding claims 2 and 37, Pramanick teaches a method, wherein the fluorine containing film is a substantially planar insulating layer. Pramanick does not explicitly teach that the substrate is a silicon wafer. Pramanick teaches a method, wherein the fluorine containing insulating layer is formed over a polysilicon gate (110; Col. 3, lines 41 – 46). Polysilicon gates are commonly formed over silicon substrates, as is well known in the art. It would have been obvious to one having ordinary skill in the art to select a silicon substrate since silicon is a known material that is well suited for the intended use.

Regarding claim 3, Pramanick teaches a method, wherein the fluorine containing film has exposed sidewalls.

Art Unit: 2811

Regarding claim 4, Pramanick teaches a method, wherein the fluorine containing film has a covered top surface (117).

Regarding claims 5 – 7 and 38 – 40 Pramanick teaches a method, wherein the plasma is formed from a hydrogen bearing precursor gas comprising NH_3 (Col. 4, lines 61 – 64). Pramanick does not teach a method, wherein the plasma is formed from a carrier gas comprising N_2 , Ar or He. It would have been obvious to one of ordinary skill in the art to use the carrier gas since a carrier gas is needed to transport the plasma. N_2 , Ar and He are known carrier gasses that would have each been well suited for the intended use.

Regarding claims 12, 23 and 45, Pramanick teaches a method, further comprising depositing a conductive material (Fig. 4, 202; Col. 4, lines 31 – 37) in the via openings.

Regarding claims 14, 15, 25 and 26 Pramanick teaches a method further comprising depositing a silicon nitride hardmask (117) over the fluorinated layer before forming the via openings.

Regarding claims 16, 27, 34 and 47, Pramanick does not teach a method, wherein the plasma is formed in a reaction chamber from ammonia (NH_3) and argon at a pressure between 1 mTorr and 50 Torr and an RF power between 100 and 500 watts. Pramanick is silent with respect to the pressure and power used in the reaction chamber. One having ordinary skill in the art would have been required to arrive at the optimal pressure and power through obvious and routine experimentation.

Art Unit: 2811

Regarding claims 17, 28, 35 and 48, Pramanick does not teach a method, wherein the ammonia is passed into the reaction chamber at a flow rate in the range of 10 sccm to 3 liters per minute. The flow rate of delivering plasma is a known variable that is subject to optimization. It would have been obvious to one of ordinary skill in the art to find the optimal flow rate through routine experimentation. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on 703-308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.

DWO



EDDIE LEE
SUPERVISORY PATENT EXAMINER
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